

2.4: Astronomy in Asia, Africa, and Arabia.

2.4.1 Arabic Astronomers

By the end of the fifth century CE, the Western Roman Empire had fallen, plunging much of Europe into the Dark Ages. Like many other intellectual pursuits, astronomy in the West stagnated for centuries and many of the writings of the ancient Greeks were lost in the West. For example, we have no copies of Ptolemy's *Almagest* in the original Greek. However, the Arabic world managed to preserve many of these writings, which is why Ptolemy's work is mainly known by its Arabic name. These writings would be "rediscovered" in the West when the crusaders brought them back. In part, the reintroduction of these writings led to the Renaissance.

In the meantime, Arabic astronomers published their own observations. For example, al-Farghani published his own compendium in 850 CE that included correction of some of Ptolemy's errors. He also made improvements to the measurements of Earth's orbital tilt, the precession of furthest distances from the Earth to the Sun and the Moon, as well as the circumference of the Earth.



2.4.2 Indian Astronomers

Meanwhile, on the Indian subcontinent, other astronomers made some interesting observations. For example, around 600 CE, Aryabhata concluded the Moon reflects the Sun's light and that the Earth rotates. He even proposed a heliocentric model with elliptical orbits nearly a thousand years before Kepler. Varahamihira, contemporary of Aryabhata, proposed that the same force that causes objects to fall to the ground was the same that held the planets in their orbits, anticipating Newton's law of universal gravitation by a thousand years. The ideas of Aryabhata and Varahamihira, however, were not widely accepted outside their own circles and were forgotten for centuries.

By the twelfth century, invaders destroyed much of India's early astronomy, including their major observatory in Benares. The Mughal Empire did reestablish much of the early astronomy in later centuries. In particular, the ruler Maharaja of Jaipur built five observatories across India. However, much of these were also destroyed by later invasions. Despite these setbacks, many Indian astronomers were able to exchange ideas with their counterparts in the Muslim world and in China.

2.4.3 Chinese Astronomers

With the benefit of a long, stable empire, astronomy in China thrived for thousands of years, predating many of the discoveries of the Greeks. For example, there is evidence that the Chinese were able to predict eclipses as far back as 2000-1000 BCE. In addition, the Emperor Wu Ding organized the sky into 28 mansions, their equivalent to constellations. China's stability enabled a long string of astronomers to maintain records of astronomical observations that spanned 2000 years. These records, which included observations of the Sun, comets, and novae, were more complete than any contemporary sources in the West. Some of these records are still studied today. During the Tang dynasty (610-910 CE) and the Yuan Dynasty (1270-1370 CE), Chinese astronomers were collaborating with those in India and with their Islamic counterparts. Chinese astronomy had little influence outside of Asia until the Renaissance because China avoided any direct contact with the West.



2.4.4 Astronomy in the South Pacific

In the South Pacific, the Polynesian people combined their knowledge of ocean currents with studies of astronomy as tools in navigation. They even constructed navigation aids and compasses out of natural materials.



A navigation compass used by Polynesian People in the South Pacific.

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Less is known of astronomical practices in Sub-Saharan Africa, however, a number of ancient megalithic structures that were used for timekeeping have been studied. One is Ng'amoritung'a, structure on the shores of Lake Turkana in Kenya. This site includes a 2000-year-old calendar independent of any influence from the West. Researchers have also found evidence that ancient people in Africa were able to predict seasons from the orientation of the crescent moon as far back as 6500 BCE. Like other ancient people, the civilizations of Sub-Saharan Africa made astronomical observations as one of their primary means of marking the passage of time and for navigation.

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